DOCUMENTATION
For Hanford Site Visit – September 12, 2000

Request For Proposal (RFP) No. DE-RP26-00NT40774
"Demonstration of Innovative, Improved Field Methods for In Situ Delineation and Assessment of Contamination Located in Difficult Subsurface Conditions at DOE Sites"

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Agenda

Hanford Site Visit – September 12, 2000
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1:00	Welcome	DOE/Richland
	General information and purpose for site visit	DOE/NETL
	Site Visit, 200 West Area	Bechtel Hanford, Inc. and CH2M Hill Hanford, Inc.
5:00	Wrap-up	All

List of Attendees

Hanford Site Visit - September 12, 2000
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Request For Proposal (RFP) No. DE-RP26-00NT40774
"Demonstration of Innovative, Improved Field Methods for In Situ Delineation and Assessment of Contamination Located in Difficult Subsurface Conditions at DOE Sites"

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Figures and Field Stops

Figures (see following)

Field Stops (see figure with labeled stops)

Stop 1 – 216-Z-9 Crib

Stop 2 - Drive by dry groundwater well – vapor extraction passive system, 216-Z-1A

Stop 3 - Drive by outcrop consisting of gravel pit that shows a facies of coarse-grained Hanford Formation.

Figure 7-1. Schematic Illustration of Carbon Tetrachloride and Wastewater Migration Beneath the 216-Z-9 Trench in the Higher Concentration Portion of the Plume.

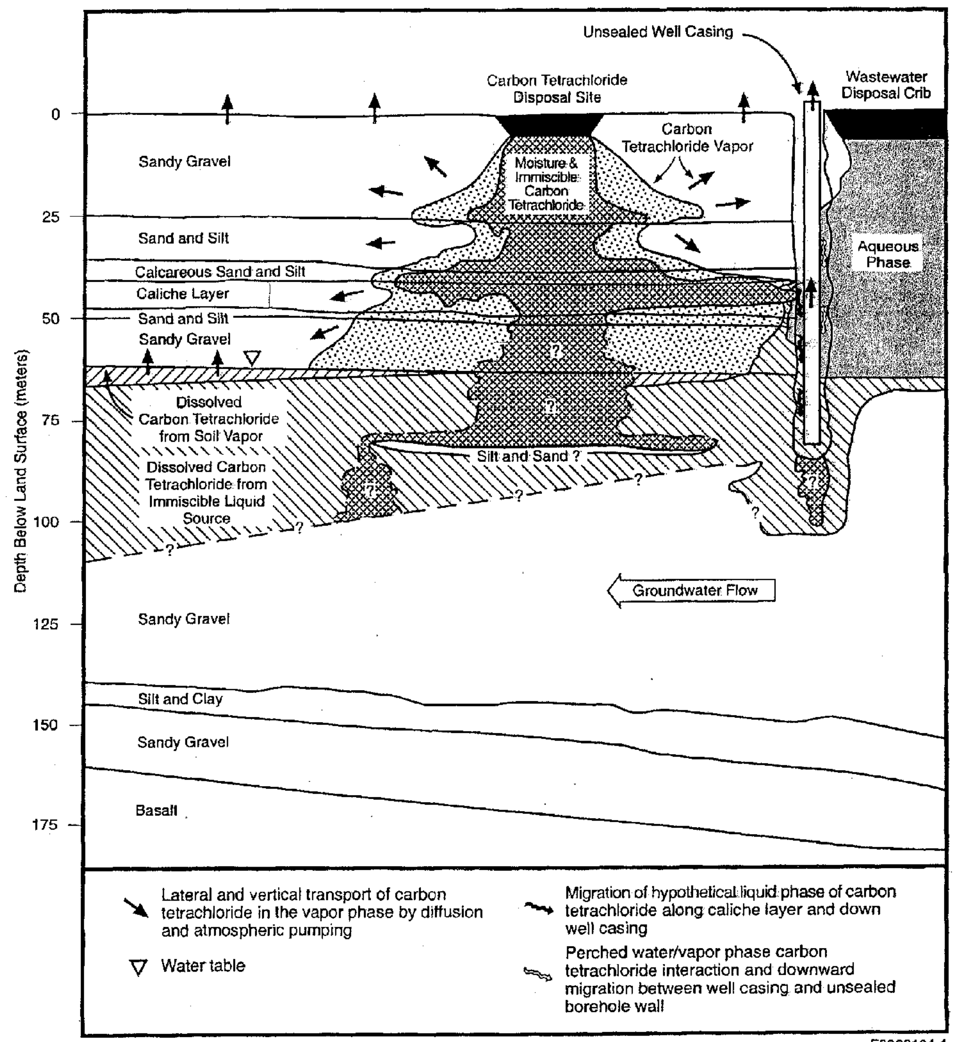

Figure 6-9a. Maximum Carbon Tetrachloride Rebound Concentrations Recorded at Wells and Deep Soil Vapor Probes Open Above the Plio-Pleistocene Unit, November 1996 - July 1997.

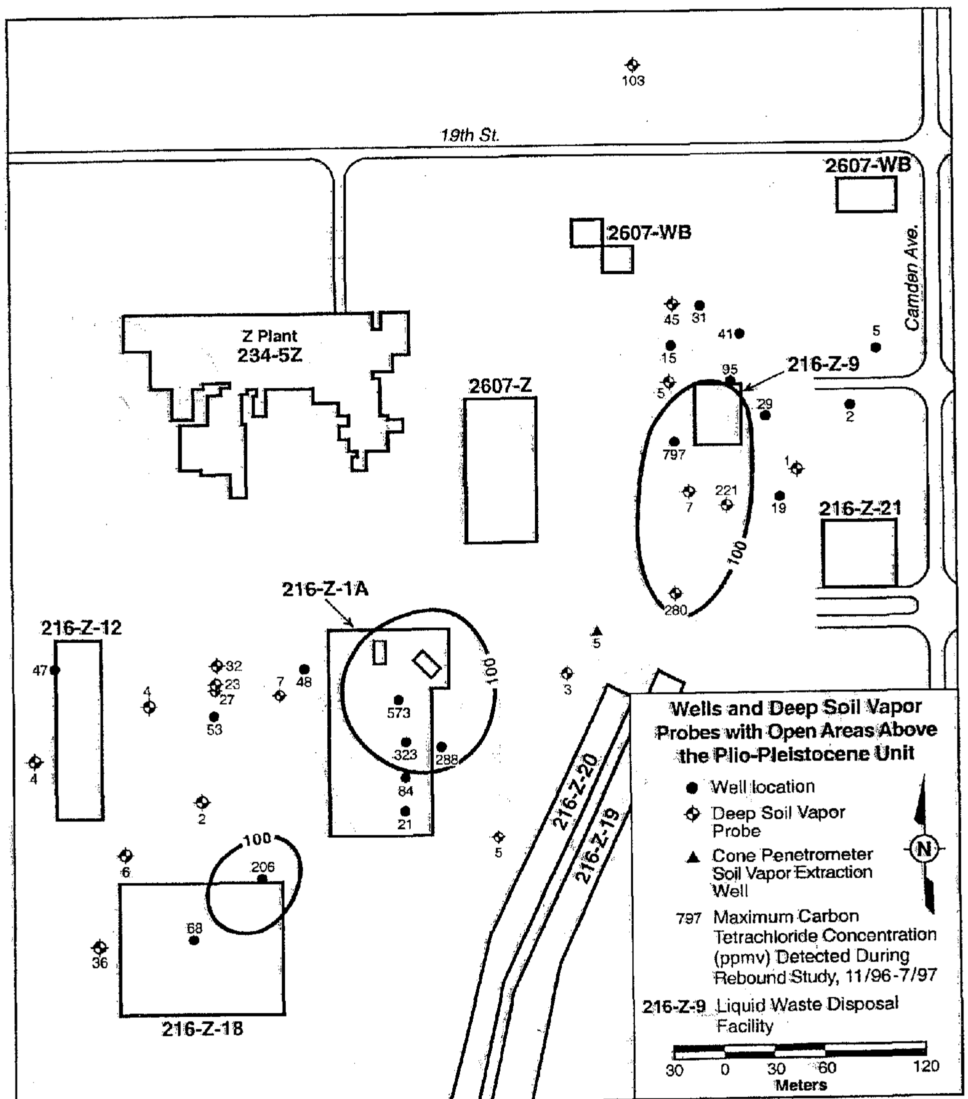

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Figure 6-9b. Maximum Carbon Tetrachloride Rebound Concentrations Recorded at Wells Open Below the Plio-Pleistocene Unit, November 1996 - July 1997.

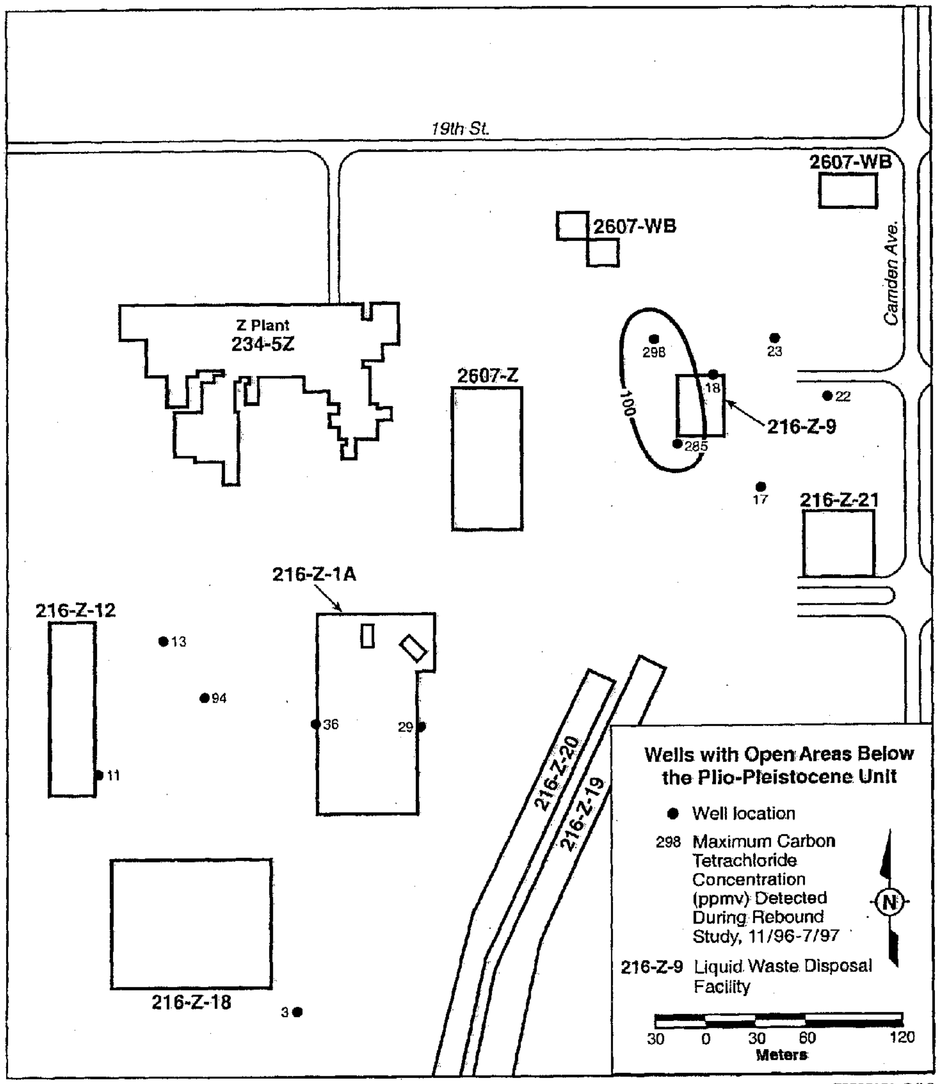


Figure E-3. Carbon Tetrachloride Concentrations in Pump-and-Treat Remediation Area, June 1996 and September 1999 (DOE-RL 2000).

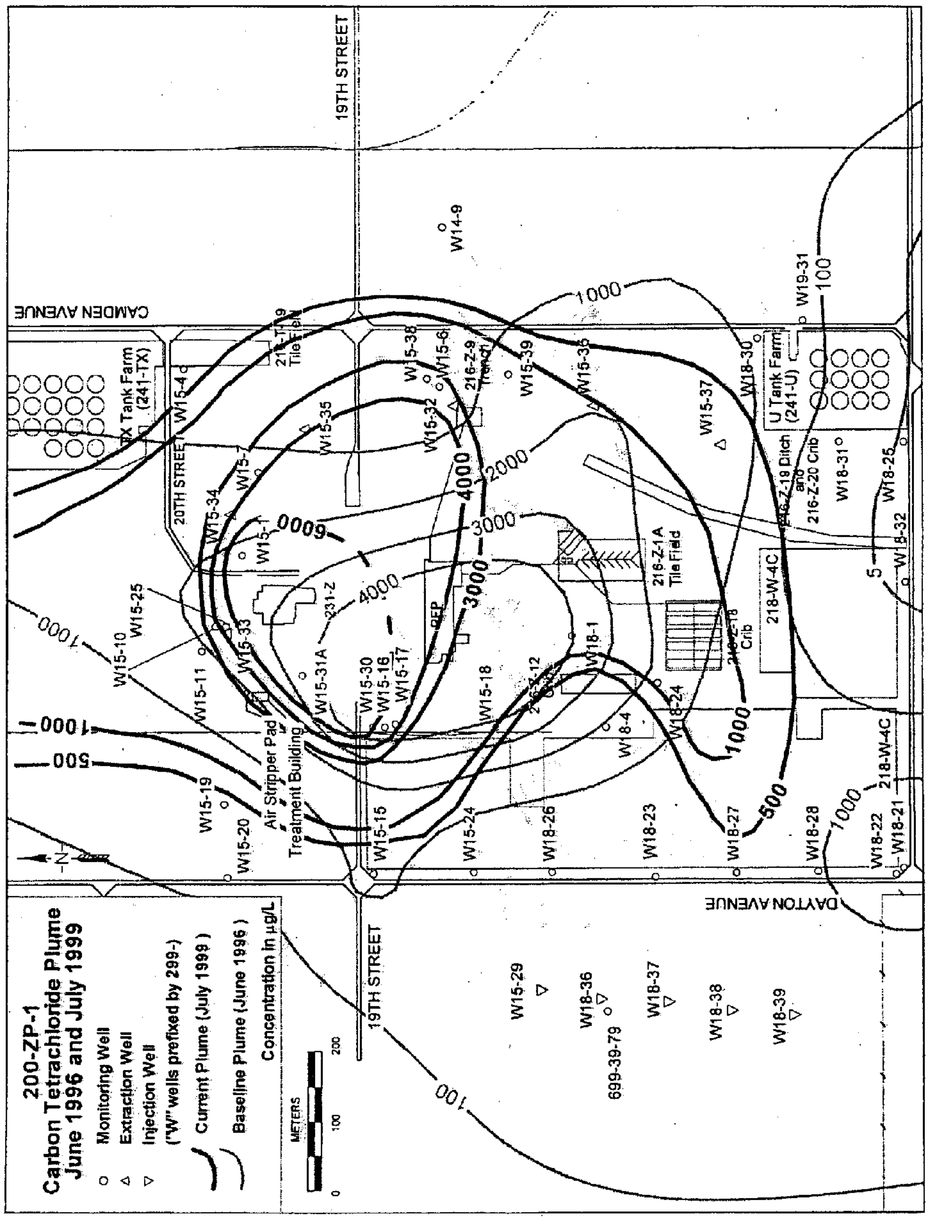


Table 2-1. Contaminant Inventory Discharged to Carbon Tetrachloride Disposal Sites.

Site	Carbon Tetrachloride (kg)	Plutonium (kg)	Americium (kg)	Carbon Tetrachloride (L)	Total Liquid (Aqueous and Organic) (L)	Operating Dates
216-Z-9	130,000-480,000	106[a]	2.5	83,000-300,000	4.09E+06	1955-1962
216-Z-1A	270,000	57	1	170,000	5.20E+06	1964-1969
216-Z-18	170,000	23	0.4	110,000	3.86E+06	1969-1973
Total	570,000-920,000	186	3.9	363,000-580,000	13.15E+06	1955-1973

[a]58 kg was later removed.

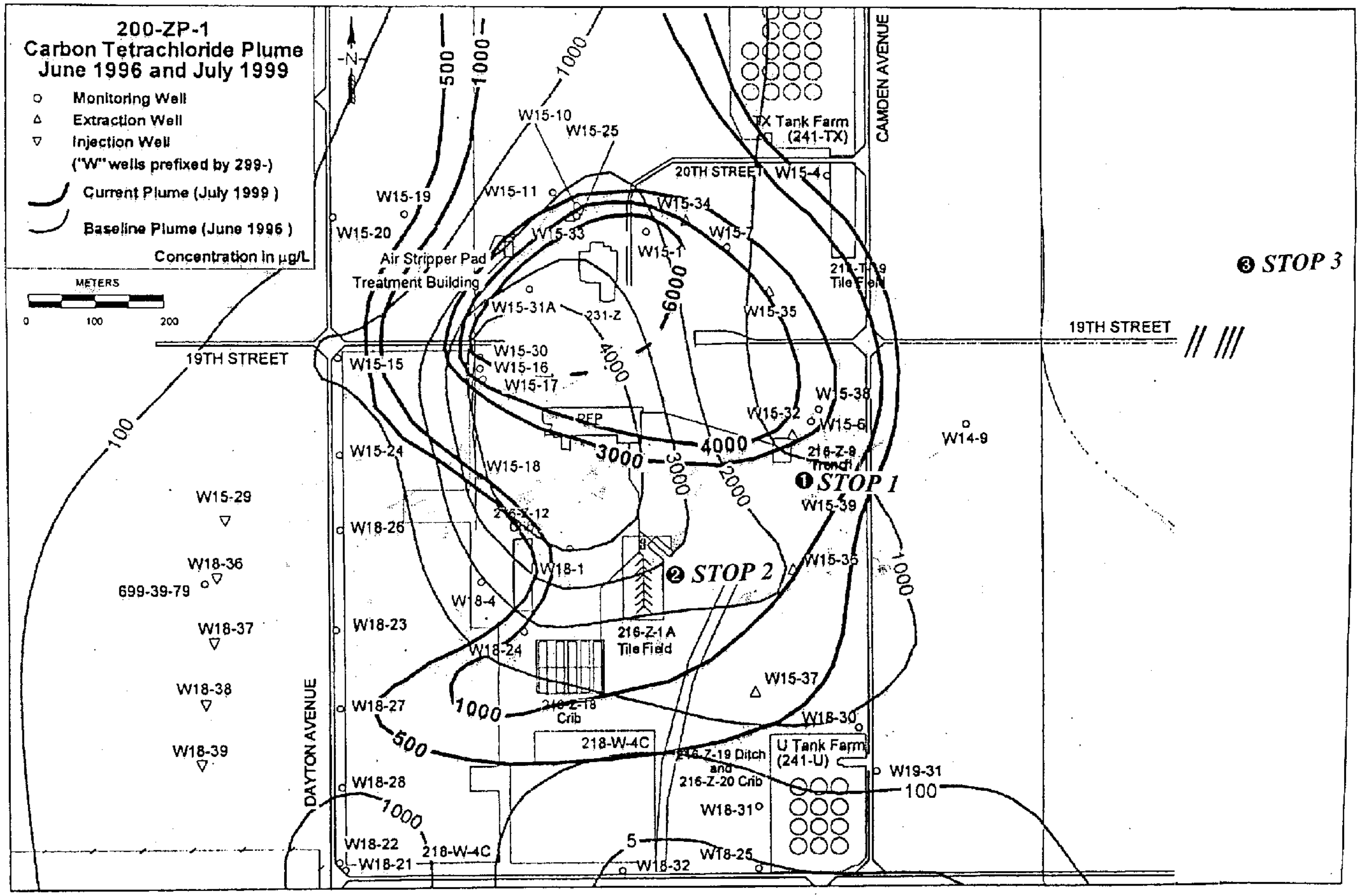
Table 2. Disposition of Carbon Tetrachloride Inventory Discharged to the Soil Column.

Carbon Tetrachloride Disposition	Percent of Estimated Original Carbon Tetrachloride Inventory (Avg. 750,000 kg)	Estimated Mass of Carbon Tetrachloride (kg)	Reference
Estimated Using Pre-Remediation Data			
Equilibrium partitioning within vadose zone into vapor, dissolved, and adsorbed phases	12	91,000	WHC 1993
Lost to atmosphere	21	159,000	WHC 1993
Biodegraded	1	8,000 (4,385 for Z-9 only)	Hooker et al. 1996
Dissolved in upper 10 m of unconfined aquifer (assuming 30% porosity and no partitioning to aquifer solids)	2	15,740	Rohay and Johnson 1991
DNAPL/residual in vadose and/or unconfined aquifer	65	484,000	WHC 1993
Measured Using Remediation Data			
Removed from vadose zone using soil vapor extraction (1992 through 1998)	10	76,000	Rohay 1999
Removed from unconfined aquifer using pump and treat (1994 through 1998)	0.3	2,100	DOE-RL 1999b

Table 3. Mass Estimate of Carbon Tetrachloride Contained in Groundwater Plume in 1990 (from Rohay and Johnson 1991).

Contour Interval (µg/L)	Area (m^2)	Median Concentration (µg/L)	Calculated Mass (kg)[a]		Percent of Total	Cumulative Percent
			Porosity = 10%	Porosity = 30%		
10 to 100	8.34 E+06	55	460	1,380	8.75	8.75
100 to 1,000	3.09 E+06	550	1,700	5,100	32.39	41.14
1,000 to 2,000	0.64 E+06	1,500	970	2,900	18.44	59.58
2,000 to 3,000	0.30 E+06	2,500	760	2,280	14.49	74.07
>3,000	0.27 E+06	5,000	1,360	4,080	25.93	100.00
Total	12.65 E+06	---	5,250	15,740	100.00	---

[a]Assuming a depth of 10 m.



200-ZP-1
Carbon Tetrachloride Plume
June 1996 and July 1999
Monitoring Well
Extraction Well
Injection Well
("W" wells prefixed by 299-)
Current Plume (July 1999)
Baseline Plume (June 1996)
Concentration in µg/L
METERS
0
100
200
19TH STREET
DAYTON AVENUE
CAMDEN AVENUE
20TH STREET
TX Tank Farm (241-TX)
U Tank Farm (241-U)
Air Stripper Pad
Treatment Building
PFP
231-Z
216-Z-9 Trench
216-Z-1A Tile Field
216-Z-18 Crib
218-W-4C
216-Z-19 Ditch and 216-Z-20 Crib
❶ STOP 1
❷ STOP 2
❸ STOP 3
100
500
1000
2000
3000
4000
6000
5

Questions and Answers

NOTE: The following references are noted in the questions and answers.

1. BHI-01311. Swanson, L.C., Rohay, V.J., and Faurote, J.M. (CH2M Hill Hanford, Inc.), 1999, Hydrogeologic Conceptual Model for the Carbon Tetrachloride and Uranium/Technetium Plumes in the 200 West Area: 1994 Through 1999 Update, Prepared for the U.S. Dept. Of Energy, Richland Operations Office, Submitted by Bechtel Hanford, Inc., BHI-01311, Rev. 0, 133 pp**. Select BHI-01311 at the following website:**
http://www.bhi-erc.com/library/bhi.htm

2. BHI-00720. Rohay, V.J. (CH2M Hill Hanford, Inc.), 2000, Performance Evaluation Report for Soil Vapor Extraction Operations at the Carbon Tetrachloride Site, February 1992-September 1999, Prepared for the U.S. Dept. Of Energy, Richland Operations Office, Submitted by Bechtel Hanford, Inc., BHI-00720, Rev. 4, 287 pp. **Select BHI-00720 at the following website:**
http://www.bhi-erc.com/library/bhi.htm

3. DOE-Hanford homepage (http://www.hanford.gov) and Hanford Site Technology Coordination Group (STCG) Website for technology need statements (http://www.pnl.gov/stcg)

4. Hanford STCG Need Number RL-SS03, " Improved, Real-time, In Situ Detection of Carbon Tetrachloride in Groundwater," (http://www.pnl.gov/stcg/fy00needs/technology/ss/rl_ss03.stm)

5. Hanford STCG Need Number RL-SS25, "Improved, Cost-effective Methods for Subsurface Access to Support Characterization and Remediation," (http://www.pnl.gov/stcg/fy00needs/technology/ss/rl_ss25.stm)

General – Questions and Answers

1.**Q**. What is PFP?

A. Plutonium Finishing Plant.

2.**Q**. Can you describe what is meant by a crib?

A. It is a subsurface disposal facility used for soil column disposal of liquid waste.

3.**Q**. Can you provide detailed characteristics of each crib such as dimensions, underlying soils? Can you provide equipment restrictions such as restrictions for driving equipment on, weight limitations, others?

A. The dimensions of the base of the crib 216-Z-9 crib are in Tables E-6 and E-7 of BHI-00720. This waste site is an enclosed, underground trench covered by a 0.23-m-thick concrete pad. The base of the trench is 18.3 m long by 9.1 m wide by 6.1 m deep. The primary access restriction is the area above the Z-9 crib; it is a pit covered with concrete panels surrounded by a fence, and is not accessible.

4.**Q**. With respect to disposal, are the demonstration areas inactive?

A. See Table 2-1 in reference BHI-00720 for dates of operation; the table is also included in this documentation.

5.**Q**. Is the plume still suspended in vadose zone?

A. Yes. Contamination is present in both the vadose zone and saturated zone.

6.**Q**. When will remediation be completed?

A. Undetermined as of this time.

7.**Q**. Is DNAPL (Dense Non-Aqueous Phase Liquids) removed in pump-and-treat operations at the source area?

A. The source area is not defined.

8.**Q**. Can you give importance of monitoring for greater than 5 ppb (parts per billion) level for carbon tetrachloride?

A. Emphasis is on monitoring carbon tetrachloride MCL (maximum contaminant level), the regulatory standard.

9.**Q** What level of carbon tetrachloride do you see in the confined zone?

A. See reference BHI-01311, section 3.0.

10.**Q**. What is current monitoring system?

A. See references BHI-01311, section 3.1.3 and BHI-00720, section 6.0.

11.**Q**. Do you currently have plans to install more wells?

A. Yes. New installations will be to upgrade current monitoring systems and to meet RCRA (Resource Conservation and Recovery Act) and other requirements.

12.**Q**. What are groundwater flow rates at source area?

A. The source area is not defined. Also see reference BHI-01311, section 2.2.1.

13.**Q**. What is the relative importance of vadose zone versus saturated zone monitoring at the site? For example 50-50?

A. Both the saturated zone and vadose zone are important to monitor from regulatory and worker health and safety aspects. The groundwater is actively being monitored as required in the Record of Decision under CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act). Vadose zone monitoring falls under an Action Memorandum.

14.**Q**. What depth profiling techniques have been piloted or field-tested at the site?

A. Examples of depth profiling techniques include: a depth-discrete groundwater sampling devise, KABIS (BHI-001311 Table A-1); cone penetrometer to monitor vapor as the probe advanced; and field testing of a modification of SEAMIST borehole liner to collect depth-discrete soil vapor samples as drilling advanced.

15.**Q**. Can you provide details of current groundwater sampling protocol?

A. The procedure used to collect groundwater samples can be found at the following URL: http://www.bhi-erc.com/library/manuals/bhi-ee01/4-1.doc

16.**Q**. Can you provide details of typical well construction in area of contamination—screened interval, well diameter, materials of construction?

A. See reference BHI-00720, section 2.2 for summary.

17.**Q**. What is the range of depths for wells in the area of contamination?

A. See references BHI-01311, section 3.1.3 and Table A-1, and BHI-00720, section 2.2 and Figures 2-2a through 2-2c.

18.**Q**. Are you purging wells?

A. Yes.

19.**Q.** Is well purging considered necessary for collecting representative formation groundwater?

A. Currently, all wells are purged before sampling. Other sampling techniques are being investigated.

20.**Q**. Are bailing techniques being used?

A. Typically, wells have submersible pumps installed in them. In the past, some wells have been bailed (see BHI-01311 Table A-1, p. A-7).

21.**Q**. Why will two areas be selected for field testing in Phase I as indicated in the draft Statement of Work? Where will the demonstration sites be?

A. See Draft Statement of Work contained in Information Package posted on the DOE/NETL business page under this solicitation notice No. DE-RP26-00NT40774 at: http://www.netl.doe.gov/business/solicit

Two areas are planned for testing in Phase I in order to gather adequate performance data and for determination of continuance into Phase II. The demonstration sites will be selected in conjunction with the Hanford site, and are expected to be located in the 200 West Area. Once the solicitation is issued, it should be reviewed for final requirements.

22.**Q**. What is the planned depth for the characterization in this study?

A. See Draft Statement of Work contained in Information Package posted on the DOE/NETL business page under this solicitation notice No. DE-RP26-00NT40774 at: http://www.netl.doe.gov/business/solicit

Once the solicitation is issued, it should be reviewed for final requirements.

23.**Q**. What time of the year will fieldwork be conducted?

A. There are no seasonal constraints for the fieldwork, but scheduling must be done in coordination with Hanford. (See draft Statement of Work posted on the NETL website business page.) Once the solicitation is issued, it should be reviewed for final requirements.

24.**Q**. What is general climate? Annual rainfall?

A. The area has a relatively mild climate, with an estimated more than 300 days of sunshine each year. Annual precipitation averages less than 7 inches. In winter, snowfall is uncommon and temperatures average in the 40's. In summer, temperatures average in the 80's.

25.**Q**. What level of security clearance will be required to work at the site?

A. A security clearance will not be required. However, approving foreign nationals to work on the Hanford Site will involve delays and possibly access restrictions.

26.**Q**. Is there interest in technologies focused on drilling?

A. Yes, but the draft Statement of Work should be reviewed to fully understand the study's twofold objectives including access in difficult conditions and contaminant characterization; specific performance requirements desired for successful technologies are also provided. (See draft Statement of Work posted on the NETL website business page.) Once the solicitation is issued, it should be reviewed for final requirements.

27.**Q**. Is it possible to put a drill rig over area where demonstration sites are?

A. Selectively, yes.

28.**Q**. Is drilling mud allowed?

A. This will be evaluated and permitted on a case-by-case basis.

29.**Q**. For the planned demonstrations, how will drilling waste be disposed?

A. All wastes will be dispositioned by Bechtel Hanford, Inc.

30.**Q.** Are subsurface conditions in the tentative demonstrations areas acidic? For example, will metal corrode?

A. The native soils in this area are basic and have the capacity to neutralize large volumes of acidic wastes. Subsurface conditions should be mildly basic.

31.**Q**. What is the desired frequency of sampling/analyses for VOCs (volatile organic compounds)?

A. Specific performance requirements desired for successful technologies are currently provided in draft form in the draft Statement of Work posted on the NETL website business page. Once the solicitation is issued, it should be reviewed for final requirements.

32.**Q**. Will there be a requirement to collect other field parameter data (e.g. temperature, flow velocities, pH, others?) in addition to DNAPL/dissolved phase DNAPL?

A. Specific performance requirements desired for successful technologies are currently provided in draft form in the draft Statement of Work posted on the NETL website business page. Once the solicitation is issued, it should be reviewed for final requirements.

33.**Q**. What level of radiation can be expected on the surface and subsurface in the tentative demonstration areas?

A. Radiation levels at the surface are at background. Various activities of subsurface transuranic radionuclide contamination can be expected.

34.**Q**. If equipment is radiologically contaminated, will the government compensate the contractor for the equipment?

> **A.** The DOE expects the contractor to design the equipment to minimize the potential for complete contamination and to utilize simple components that would be considered consumable. In addition, the DOE is expecting offers from companies that have experience in handling hazardous wastes. DOE would expect that adequate insurance coverage already exists for potential contamination problems and that this insurance is already accounted for as part of the contractor's normal course of business (as part of their indirect rates) and that this contract would pay its fair share through allocation, and reimbursement, of indirect costs to the contract. If no such insurance coverage exists, the cost principle found at FAR 31.205-24 applies.

35.**Q**. Why will awards from this solicitation be no fee type contracts?

> **A**. Cost-sharing will be encouraged from the offerors for there should be a significant market within DOE and elsewhere for successful technologies that meet these technical needs; cost-sharing does not permit fees.

36.**Q**. Who do I ask if I have questions at a later time?

A. Contact the Contract Specialist named in the CBD Announcement to Synopsize Solicitation No. DE-RP26-0NT40774, posted August 2, 2000 – James W. Huemmrich, phone (412)386-6597; fax (412) 386-6137, e-mail: huemmric@netl.doe.gov, address: DOE/National Energy Technology Laboratory, P.O. Box 10940, MS 921-107, Pittsburgh, PA 15236-0940.

<u>Stop 1. – Questions and Answers</u>

37.**Q**. How much carbon tetrachloride was disposed of in the area of contamination?

A. See reference, BHI-00720, Table 2-1. For the combined, three disposal areas of interest (the 216-Z-9 Trench, the 216-Z-1A Tile Field, and the 216-Z-18 crib), current estimates are approximately 570,000-920,000 kilograms total of liquid carbon tetrachloride (in mixtures) disposed from 1955-1973. Also see reference BHI-01311, section 3.1.1.

38.**Q**. What co-contaminants are present with carbon tetrachloride?

A. See reference BHI-01311, section 3.1.5 and reference BHI-720, section E.5.

39.**Q**. What is Hanford's shortlist for remediation technologies? Has *in situ* chemical oxidation been considered as a remediation technology?

A. There currently is not one; the site is years away from finalizing. Yes, *in situ* chemical oxidation has been considered.

40.**Q**. Is area adequately covered by existing wells for the purposes of monitoring?

A. No.

41.**Q.** Please provide a list of VOC's that the site considers important to monitor.

A. Carbon tetrachloride, trichloroethylene, tetrachloroethylene, chloroform, and others (see references BHI-00720 and BHI-01311). For this particular technology study, when the solicitation is issued, it should be reviewed for requirements of this technology demonstration.

42.**Q**. Is there monitoring for metals at this site (stop 1)?

A. Not at this particular site.

43.**Q**. Are groundwater samples contaminated with radiological contaminants?

A. Yes.

44.**Q**. Have any changes in the level of the water table been noted in recent years?

A. See reference BHI-01311, section 2.2.1. Yes, it has been dropping, typically, 1.5 feet per year (0.45 meters per year) in the recent past.

45.**Q**. How well do you know groundwater flow rates? How are they monitored?

A. See reference BHI-01311, section 2.2.1.

46.**Q**. How much time is required to purge wells?

A. Typically, a few hours are required for stabilization.

47.**Q**. What data levels are needed to fulfill requirements for site?

A. This is an area that needs to be further investigated and defined. For this particular technology study, the issued solicitation should be reviewed for requirements of this technology demonstration.

48.**Q**. Are baseline costs for monitoring available?

A. See reference Hanford STCG need RL-SS03. Baseline includes well sampling and laboratory analyses. Typical costs are $1,500 for sample collection per well, and $175 per sample analysis.

49**.Q**. What would be the benefits resulting from innovative technologies that could successfully provide access to contamination in difficult conditions, and in situ monitoring of contamination levels?

A. There would be numerous benefits including: reduction in waste management; reduction in risk to workers; improved, more accurate monitoring of the plume; cost savings; and others.

50.**Q**. Have any innovative, in well monitoring techniques been tested here at Hanford?

A. Yes. The colloidal borescope was tested. See following website reference:
http://ost.em.doe.gov/tms/Communicate/TkCpSsPv.asp?TSSID=1135&tDisplay=funding&TechID=465

51.**Q**. Are subsurface utilities mapped?

A. Information is available on subsurface utilities, and this would be provided to the successful offeror.

52.**Q**. What power is available (at stop 1)? What potable water is available at this site?

A. The electrical power that is available at a nearby facility is 480 V. A plug-in to this could be made available. A water line containing potable water is also nearby.

53.**Q**. Does the waste management plan mentioned in the Draft Statement of Work need to be approved by regulators? If so, how long does this typically take?

A. Yes. It typically can take from several weeks to several months for approval, with the duration dependent on a number of variables.

54.**Q**. In the demonstration areas of interest for this study, is the subsurface all radiologically contaminated?

A. The majority of the subsurface is radiologically contaminated to some extent.

<u>Stop 2 – Questions and Answers</u>

55.**Q**. What are typical cost savings of this passive treatment system compared to active?

A. Over a 20-year project life, savings have been estimated at greater than $3 million.

<u>Stop 3</u>

No questions.

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National Energy Technology Laboratory

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NETL

We Solve National Energy and Environmental Problems

September 7, 2000

TO POTENTIAL OFFERORS AND OTHER INTERESTED PARTIES

INFORMATION PACKAGE

1. INTRODUCTION/INSTRUCTIONS

The Statement of Work (SOW) for Request For Proposal (RFP) No. DE-RP26-00NT40774 entitled "Demonstration of Innovative, Improved Field Methods for In Situ Delineation and Assessment of Contamination Located in Difficult Subsurface Conditions at DOE Sites" is being released in **draft form** to provide an opportunity for potential offerors to review and become familiar with the requirements. Prospective offerors are invited to comment on all aspects of the information provided herein; however, special emphasis is requested in the following areas:

1) Overall adequacy of the SOW description.
2) Identification of information not covered which will make the SOW more thorough.

The DOE will consider all timely comments submitted on the information contained herein, but makes no guarantee that any comment or group of comments will result in identifiable changes to the solicitation. **Comments should be submitted to Mr. James Huemmrich via Internet at "huemmric@netl.doe.gov," by mail, or FAX at (412) 386-6137, no later than October 6, 2000.**

The DOE is under no obligation to respond to individual comments or questions, nor is it responsible for any costs associated with preparation of responses to this request or costs associated with future proposal preparation.

Offerors are cautioned that the information provided herein is not all inclusive, and is subject to change at the discretion of the DOE.

2. RELEASE OF ENTIRE SOLICITATION

The solicitation should be available on or about October 19, 2000; a 45-day response time is anticipated. The solicitation will be posted on the NETL Homepage for distribution purposes; offerors are encouraged to download the solicitation. Any amendments to the solicitation will also be posted on the NETL Homepage; offerors are therefore encouraged, after issuance of

REPLY TO: Pittsburgh Office
Voice (412)386-6597 ● FAX (412)386-6137 ● huemmric@netl.doe.gov ● http://www.netl.doe.gov

the solicitation, to periodically check the NETL Homepage, to ascertain if any amendments have been issued.

3. CONTRACT TYPE

Cost-Reimbursement/No Fee Contracts.

4. AWARDS

Multiple awards are anticipated, with possible downselections after completion of Phase I; the Government, however, reserves the right to award any number of awards deemed in its best interest.

5. SMALL BUSINESS SIZE STANDARDS AND SET ASIDE INFORMATION

The proposed solicitation will be a partial small business set aside; one award will be set aside for a small or small disadvantaged business. For purposes of this solicitation, a small business is defined as having 500 or less employees. The Standard Industrial Classification (SIC) Code is 8731

6. BACKGROUND

NETL's Industry Program is coordinating with the Subsurface Contaminant Focus Area (SCFA) and the Hanford Site to address technology needs identified by the DOE Nuclear Weapons Complex sites for soil and groundwater contamination and cleanup that occurs in difficult subsurface conditions. These difficult subsurface conditions include, but are not limited to, the following: beneath buildings and other manmade structures such as underground tanks and buried pipelines; at depths that reach up to 45 meters or more; in difficult-to-penetrate sediments that include beds of gravel, layers of caliche, and others; and in highly heterogeneous geologic settings that include sediment facies containing complex interbeds and structures that provide conditions that are difficult to model and predict fluid flow through. The needs are also focused on difficult contamination, namely Dense Nonaqueous Phase Liquids (DNAPLs; carbon tetrachloride, trichloroethylene, tetrachloroethylene, and others) in these difficult subsurface conditions. Improved, more cost-effective technologies are required that operate in these conditions to: (1) access the contamination, and (2) perform in situ characterization to determine spatial distribution and quantity in concentration levels.

Selected technologies will be required to provide and demonstrate a methodology to access DNAPL contamination in difficult subsurface conditions, and to conduct in situ characterization of DNAPL contamination to determine spatial distribution and quantity in concentration levels. Novel and breakthrough technologies that do not duplicate existing methods, and that complement or enhance existing or planned work, thereby best serving the needs of the Environment Management Program, are desired. The selected technology must be at an advanced maturity level (advanced engineering development stage or higher; successful proof of concept testing completed and available for review) to permit final design and development of the technology system to be completed, then demonstrated at one or more DOE sites. The technology must demonstrate clear benefits to DOE (superior technical performance, reductions in cost, schedules, and risks to workers, the public, and the environment) and be acceptable to end-users at multiple sites within the DOE Complex.

This will be a phased procurement with multiple awards likely, and possible downselection. Proposed technologies are sought that may be a device, process, material, method or integrated system, that can access contamination in difficult conditions in both the vadose zone and saturated zone, then characterize contamination by determining spatial distribution and quantity in concentration levels. The first phase will be to complete the technology system final design, construction of the prototype system, control testing of the prototype, and field testing at two areas selected by the demonstration site with each area bound by surface dimensions of approximately 95 meters by 95 meters. The second phase will be to complete full scale demonstration of the technology system at the demonstration site in an area that is bound by surface dimensions of approximately 230 meters by 230 meters. Both the access system and the contamination assessment methodology will be evaluated as part of the demonstration. Demonstrations will first be conducted at Hanford and be targeted at carbon tetrachloride contamination, but subsequent demonstrations at other DOE sites targeting other DNAPL contamination may be performed. It is expected that testing will be conducted at Hanford in the 200 West Area, and that operation in both the vadose zone and saturated zone will be required.

7. DRAFT STATEMENT OF WORK

See Attachment 1. Also see supplemental background information provided (Attachment 2).

8. AVAILABILITY OF FUNDS

Reference FAR 52.232-18. The Government's obligation under any contract awarded is contingent upon the availability of appropriated FY2001 funds.

ATTACHMENT 1

DRAFT STATEMENT OF WORK

"Demonstration of Innovative, Improved Field Methods for In Situ Delineation and Assessment of Contamination Located in Difficult Subsurface Conditions at DOE Sites"

A. SCOPE OF WORK

DOE Nuclear Weapons Complex sites contain soil and groundwater contamination that occurs in difficult subsurface settings that provide challenges to efficiently and cost-effectively access the contamination to accurately characterize its location and quantity. Specific examples of subsurface conditions where contamination can be located and difficult to access include, but are not limited to, the following: beneath buildings and other manmade structures such as underground tanks and buried pipelines; at depths that reach up to 45 meters or more; in difficult-to-penetrate sediments that include beds of gravel, layers of caliche, and others; and in highly heterogeneous geologic settings that include sediment facies containing complex interbeds and structures that provide conditions that are difficult to model and predict fluid flow through. The objectives of this study are twofold and include development and demonstration of a technology system that can: 1) access contamination located in both the vadose zone and saturated zone, in difficult subsurface conditions such as those conditions named above and, 2) use in situ field measurement techniques to determine both contaminant spatial distribution and quantity in concentration levels. Results shall be provided in near real-time, and meet the DOE demonstration site requirements for specifying contaminant spatial distribution, and detecting and quantifying contaminant concentration levels. The technology system prototype shall include all equipment/instrumentation hardware, software, operational plans, operating procedures, other support documentation, and any other components required to operate the system. End products of this project shall be submitted to DOE and shall include the technology system prototype and all data results collected in the development and demonstration of the technology system.

The technology system shall be designed to perform under broad operating conditions that exist at DOE waste or contaminated sites. Initially, field tests and demonstration of the technology system shall be completed at a DOE site such as Hanford, and field test areas shall be selected in conjunction with the demonstration site. The sites shall contain conditions that are representative of difficult subsurface settings such as those named above, and the technology system prototype development and testing shall be targeted toward Dense Nonaqueous Phase Liquids (DNAPL) contamination specified by DOE and the demonstration site. Field tests shall also include independent methods to validate operating performance and data results of the technology system in terms of the twofold objective: the ability to access contamination in difficult settings, and the ability accurately determine contaminant spatial distribution and quantity in concentration levels. The technology system may also be deployed to other DOE sites for the purposes of collecting additional performance and cost benefit data.

B. TASKS TO BE PERFORMED

The Statement of Work for this demonstration is structured into Phase I and Phase II. Phase I shall include: advanced engineering design of prototype system, building of prototype system, factory/laboratory/field control tests, field tests at selected DOE demonstration sites containing conditions representative of difficult subsurface settings, independent validation of test results, and supporting activities. Phase II shall include full scale demonstration of the technology system at a selected DOE site containing conditions representative of difficult subsurface settings, independent validation of test results, and supporting activities A project review and contract decision point for continuance of the contract into Phase II (contract go/no go decision point), shall be a milestone placed between Phase I and Phase II. The contractor shall provide all labor, equipment, and materials to complete the following tasks.

PHASE I

Task 1.0--Coordination and Planning

This task shall consist of necessary activities to ensure coordination and planning of the project with DOE/NETL, the selected DOE demonstration site, potential end-users of the technology, and the DOE Environmental Management (EM) technology development program. The roles and responsibilities of the project team in these interactions shall be clearly identified and be provided for review and approval by DOE and DOE-selected representatives. The contractor shall coordinate with the selected demonstration site in planning, preparing, and submitting for review any specific documents that shall be required by the demonstration site and by DOE/NETL. The contractor shall also coordinate with the selected demonstration site to ensure that the performance requirements and end-user needs for the technology demonstrations are fully understood and shall be met for the project. Other coordination activities shall include, but are not limited to the following.

Project Kick-off Meeting
Contractor shall brief DOE and DOE-selected representatives of project plans at a Kick-off meeting at a site selected by DOE.

NEPA Documentation
The contractor shall provide appropriate levels of NEPA documentation required for the project to DOE and DOE-selected representatives.

Document preparation and submission
Other documents necessary for coordination and planning of the project activities, as identified by DOE/NETL and the selected demonstration site, shall be prepared and submitted for review and approval to DOE and DOE-selected representatives. These may include, but are not limited to, submission of a Quality Assurance Project Plan and submission of a plan to fulfill ES&H (Environmental, Safety, and Health) requirements of the demonstration site for the planned field

tests and activities. Other required reporting documents are listed in the contract Reporting Requirements List.

Task 2.0--Test Site Selection/Assessment in Preparation for Advanced Engineering Design of Prototype System and Field Test Design

In conjunction with the DOE demonstration site and DOE/NETL, the contractor shall complete final site selection for the Phase I field tests. A minimum of two sites shall be selected that are representative of subsurface conditions considered difficult to access and characterize contaminant spatial distribution and quantity. Upon selection, the contractor shall coordinate with DOE demonstration site representatives to collect background information regarding the site necessary to complete final design of the technology system and plan the technology field tests in Phase I. This inventory of information may include, but is not limited to the following: physical characterization data including well data, geologic data and models, hydrologic data and models, geophysical surveys, and others; history of the site; and contamination information. Other site data may be required that is technology specific information, and the contractor shall coordinate with the DOE demonstration site to determine availability. The contractor shall provide to DOE and DOE selected representatives, base maps for the selected field tests sites that are of appropriate scale.

Task 3.0-- Advanced Engineering Design, Constructing of Prototype System, and Control Testing

The contractor shall conduct all activities necessary to complete design and constructing of the technology system prototype, and any required control testing offsite to the demonstration site, that shall be necessary to ensure proper operation of the prototype prior to conducting field tests at the demonstration site. This shall include any required detailed design for the prototype system. This shall also include constructing of the prototype system that may include equipment/instrument fabrication and software development, and any control tests in a laboratory, factory, field site or other setting that is offsite to the demonstration site. Results of the offsite control testing shall be provided to DOE and DOE-selected representatives for review.

Engineering Design
The selected technology system is required to be at the advanced engineering stage (proof of concept testing and/or preliminary field testing previously conducted and available for review), in which previous design work had been completed. This design activity shall proceed from design work completed prior to this project, and complete any necessary modification and/or final design of the technology system. As the technology may be an integrated system, this may include, but is not limited to final design of equipment/instrumentation hardware, software, or any other components. Final system design shall be submitted to DOE and DOE selected representatives for review.

Constructing Prototype System

This activity shall consist of acquisition of necessary parts and materials, and constructing of the prototype technology system. This may include, but is not limited to, fabrication of equipment/instruments, development of software, and building and integration of any subsystems that comprise the entire prototype technology system.

Control Testing Prototype System

This activity shall consist of any factory, laboratory, or field testing offsite to the demonstration site, that shall be necessary to ensure proper operation of the prototype technology system. A plan of the proposed control testing shall be provided to DOE and DOE-selected representatives for review.

Task 4.0--Test Plan

The Contractor shall develop and submit to DOE and DOE-selected representatives for review, a detailed test plan for the field testing of the technology system designed to meet the twofold objectives: access contamination located in both the vadose zone and saturated zone in difficult subsurface conditions and, use in situ field measurement techniques to determine both contaminant spatial distribution and quantity in concentration levels. The test plan shall detail the technical and operational elements of this testing. The test plan shall be written in the context of the selected DOE demonstration site and shall contain all components required by the host site. The test plan must be approved prior to site mobilization to the demonstration site for the field tests. Typical components of a test plan include, but are not limited to, the following: technology description; field test objectives; experimental design and procedures; site preparation, equipment, and materials; sampling and analyses plan; data management; data analysis and interpretation; Environmental, Safety, and Health (ES&H) plan; waste management and decontamination plans; public participation; reporting; schedules; regulatory compliance; project organization; and supplementary material (provides more detailed information for field sampling plan, quality assurance project plan, ES&H plan, waste management plan, public participation plan, readiness review plan, regulatory compliance plan, and standard operating procedures). The test plan shall also include a plan for the verification of the field test results using independent field sampling data, control tests, or other acceptable means.

The draft test plan shall be submitted to DOE and DOE-selected representatives at the demonstration site and DOE/NETL for review and approval. Any modifications must be made, and the test plan must be resubmitted and accepted for approval.

Task 5.0--Field Tests and Support Activities

Contractor shall conduct field tests at a minimum of two sites selected jointly by the contractor, the DOE demonstration site, and DOE/NETL using the prototype system developed to access the difficult subsurface conditions to determine contaminant spatial distribution and quantity in concentration levels. Task shall include activities necessary to complete verification of these field test results using independent field sampling, control tests, or other acceptable means. Task also includes support activities necessary to complete field testing such as, but not limited to, the following: site mobilization/demobilization, site preparation, facilities/utilities requirements, waste management and decontamination, and site restoration. The test plan must be approved by DOE and DOE selected representatives of the demonstration site prior to conducting these activities. The contractor shall coordinate fully with the demonstration site to perform these activities as planned in the approved test plan.

Mobilization and Demobilization
The contractor shall coordinate with the demonstration site to mobilize and bring the prototype technology system to the site along with all required personnel. At completion of field testing activities, the contractor shall demobilize equipment and personnel.

Site Preparation, Facilities/Utilities, and Waste Management Preparation and Management
Prior to any site work, all ES&H document control and reporting, regulatory document and control reporting requirements, and any other site-specific documentation must be submitted and approved by the DOE demonstration site.

This element includes the Contractor's responsibility to coordinate with the demonstration site DOE and contractor representatives for all required site preparation, utilities, waste management, and other specific resources required to support the demonstration project. These requirements are technology specific, and the contractor shall coordinate with the demonstration site to ensure that all required support is readied prior to commencing of field testing. For example, this may include preparing a staging area for equipment and other materials needed during the field demonstration. In addition, the contractor shall coordinate with the demonstration site to ensure all facilities/utilities requirements needed for the field demonstration are readied. The contractor shall provide sources for these requirements, as coordinated with and approved by the demonstration site. The contractor shall also coordinate with the demonstration site in determining waste management requirements and health and safety requirements for the field testing. The contractor shall coordinate with the demonstration site to ensure waste management requirements prior to, during, and after any field testing are met.

Field Tests
The contractor shall complete the necessary activities to conduct field testing of the prototype technology system at the demonstration site according to the approved test plan, to access the subsurface, and to determine contaminant spatial distribution and quantity in concentration levels. The contractor shall coordinate with the demonstration site representatives to ensure that all site requirements are met prior to, during, and after the field tests.

It is expected that the demonstration sites selected will contain subsurface conditions that are representative of areas that are difficult to access and characterize contamination in, such as the DOE Hanford 200 West Area, 200-ZP-1 Operable Unit. It is expected that DNAPL carbon tetrachloride contamination in both the vadose zone and saturated zone will be the target of the studies. Two test areas or field cells shall be selected for completion of the field testing. Each test area or field cell shall include a minimal field area that is bound by surface dimensions of approximately 95 meters by 95 meters. Each test area or cell may contain existing wells varying in number from zero to four. Contamination concentration levels within the designated test areas or cells, may vary for the targeted contaminant. Contamination may be found in the vadose zone, the saturated zone, or both.

The operational conditions are expected to fall within the following: required depth of operation ranges from surface to 110 meters; operation required in both the vadose zone and saturated zone for both the access methodology, and the methodology for determining contaminant spatial distribution and quantity in concentration levels; carbon tetrachloride contamination that may be present in the vadose zone (soil vapor, soil moisture, sorbed to solids, and residual) and the groundwater that is expected to range from minimum of 5 micrograms per liter to maximum of 10,000 micrograms per liter; carbon tetrachloride contamination may reside with other co-contaminants that may be radionuclides and other chemicals; subsurface settings that contain one or more conditions described as difficult-to-access such as beneath and around buildings and other man-made structures such as underground tanks and buried pipelines; layers of gravel; layers of caliche; complex sediment facies such as interbeds of silt, sand, and gravel and/or beds containing structures such as fractures and clastic dikes.

The tests shall include operation of the prototype technology system for data collection, reduction, analyses, and interpretation. Field testing interval shall be the length of time specified in the approved test plan. Not later than 48 hours from the start of the testing, initial test results from the data acquisition shall be provided in a "Quick Look" report that shall be in a format that is specified in the approved test plan. All results from the testing, shall be provided at the time intervals and in a format that was specified in the approved test plan. Testing results shall also be provided in the Topical Report submitted at the completion of Phase I.

Initial test results shall be evaluated, as specified in the approved test plan, to determine if the prototype system is operating properly. Minor modifications or adjustments to the system may be completed to enhance operation of the technology system, and retesting may be completed. The contractor shall coordinate with the DOE demonstration site to determine the degree and length of any retesting that may be needed and permitted at the demonstration site.

The field test results shall be evaluated with respect to meeting the twofold objectives: 1) to access contamination located in both the vadose zone and saturated zone in difficult subsurface conditions and, 2) use in situ field measurement techniques to determine both spatial distribution and quantity of contamination (concentration levels). The number of and degree to which the following performance criteria are met shall be evaluated:

- Ability to access and determine carbon tetrachloride (CCl_4) concentration levels in vadose zone (soil vapor, soil moisture, sorbed to solids, and residual) and groundwater in difficult subsurface conditions that include complex sediment facies, gravel, caliche, beneath man-made obstructions, and excessive depths (greater than 85 meters). Must be capable of measuring CCl_4 levels in groundwater ranging from maximum of 10,000 micrograms per liter CCl_4 to minimum of 5 micrograms per liter CCl_4. CCl_4 may occur in both aqueous phase and free phase (DNAPL).

- Capable of depth profile measurements ranging from the surface to depths of approximately 110 meters and capable of making measurements at multiple depths at discrete points on scale of several centimeters.

- Ability to provide real-time measurements and data results. A system with automatic measurements that is capable of remote downloading is preferred. Technologies that take advantage of existing extraction, injection, or monitoring wells, would be permitted.

- Ability to use measured concentration levels to produce spatial plots with the location and concentration of CCl_4 contamination both above and below the water table. Ability to report results in field coordinates and through use of visualization tools to plot isopleths of concentrations. Ability to map discrete lenses and pools of variable concentrations within the entirety of the plume. Methodology may involve integration of techniques, therefore integrated results are desired within 48 hours.

- Ability to measure time-variant changes of the combined plume configuration (spatial distribution) and the concentration levels, and provide results within 48 hours.

- Non-invasive or minimally invasive, eliminate or reduce Investigative Derived Waste (IDW), and prevent cross-contamination. For example, use of sensors in existing wells, use of geophysical or other remote sensing technologies, and methodologies involving cross-hole tests reduce or eliminate IDW.

- Robust in order to operate in remote, harsh field environment where access is limited and utilities are not readily available.

- Ability to provide technology performance and results which are verifiable with independent field data, controlled tests, or other acceptable means.

- Ability to minimize operational time including rapid site mobilization, completion of operations, and demobilization. The technology should operate reliably, with minimal scheduled or unscheduled outages for maintenance or repair.

- Demonstrated cost savings compared to baseline drilling and sampling methods, and able to operate within acceptable demonstration site Environmental, Safety, and Health requirements, and regulatory and stakeholders requirements.

<u>Independent Validation of Results</u>

The contractor shall complete an independent validation of test results that were obtained with the prototype technology system, using an acceptable plan that was provided in the approved test plan. This independent validation is intended to corroborate the operation of the prototype technology system, and is intended to be a measure of its accuracy and ability to meet the performance criteria. For example, baseline sampling methods, control testing, or other acceptable means approved by DOE and the demonstration site could be used to verify field results. Results of this validation testing shall be provided as outlined in the approved test plan.

Site Restoration

The Contractor shall coordinate with DOE and DOE demonstration site representatives with regards to demobilization and site restoration, to ensure acceptable conditions upon completion of the field testing. The site shall be reclaimed to a condition as coordinated with and acceptable to the DOE demonstration site.

Task 6.0-- Reporting

The contractor shall prepare and present a briefing of Phase I results, and planned project work for Phase II, at DOE NETL or another site selected by DOE. This presentation shall take place not less than 45 days before the expiration of the Phase I contract. The contractor shall prepare for review and comments, a draft Topical Report on the Phase I contract activities. This report shall follow the guidelines set forth in the contract and shall include, but not be limited to: prototype system design, construction, and control testing; required project test plans and other documentation for the demonstration site; description of and results from Phase I testing; results from independent validation; and initial cost estimates of technology and cost benefits of technology compared to baselines and alternative technologies. After review and comment by the DOE and DOE selected representatives, the contractor shall revise the report and submit to DOE.

Attendance and presentation at Annual Industry Programs Conference. The Contractor shall attend and prepare project status for presentation at the Annual Industry Programs Contractor Review Meeting at DOE NETL.

Attendance and presentation at the Subsurface Contaminant Focus Area Annual Midyear Review. The Contractor shall attend and prepare project status for presentation at the Subsurface Contaminant Focus Area annual Midyear Review at a location to be determined.

At this time, the DOE will evaluate the merits of the project to determine if, and to what extent, Phase II (Tasks 7.0, 8.0, 9.0, and 10.0) shall be conducted. The contractor shall not proceed with these Phase II tasks unless the Contracting Officer issues a modification to the contract to exercise Phase II. If the Government elects not to pursue the Phase II tasks, the contractor shall complete all of the remaining work defined in the Phase I contract.

PHASE II. (OPTIONAL)

Task 7.0-- Coordination/Planning and Site Selection/Assessment in Preparation for Full Scale Demonstration

This task shall proceed only after the review of the Phase I contract results by DOE and DOE-selected representatives, and the approval to proceed from the DOE/NETL Contracting Officer. This task shall include activities necessary to ensure coordination and planning of the full scale demonstration with the selected demonstration site. This shall include submission of any specific documentation required by the demonstration site and by DOE/NETL. The contractor shall coordinate with the selected demonstration site to ensure that the performance requirements and end-user needs for the technology full scale demonstration are fully understood and will be met for the Phase II project. The task shall also include those activities required to select a full scale demonstration site. Other coordination activities shall include, but are not limited to the following.

NEPA and other documentation required for demonstration.
Appropriate level of NEPA documentation shall be provided to DOE and DOE demonstration site representatives. Other site-specific documentation, required by the demonstration site and by DOE/NETL to proceed with the testing, shall be submitted.

Site Selection/Site Assessment
In conjunction with the DOE demonstration site and DOE/NETL, the contractor shall complete final site selection for the Phase II full scale demonstration. Upon selection, the contractor shall coordinate with DOE demonstration site representatives to determine availability of, and to collect background information regarding the site necessary to plan the Phase II full scale demonstration. This inventory of information may include, but is not limited to the following: physical characterization data including well data, geologic data and models, hydrologic data and models, geophysical surveys, and others; history of the site; and information regarding contamination. Other site data may be required that is technology specific information, and the contractor shall coordinate with the DOE demonstration site to determine availability and receipt of such data. The contractor shall provide to DOE base maps for the selected full scale demonstration site that are of appropriate scale.

Task 8.0--Test Plan

The Contractor shall develop and submit to DOE and DOE-selected representatives for review, a detailed test plan for the full scale demonstration of the technology system designed to meet the twofold objectives: access contamination located in both the vadose zone and saturated zone in difficult subsurface conditions and, use in situ field measurement techniques to determine both contaminant spatial distribution and quantity in concentration levels. The test plan shall detail the technical and operational elements of this testing, and shall include a plan for the verification of the technology system field test results using independent field sampling, control tests, or other acceptable means. The test plan shall be written in the context of the selected DOE demonstration site and shall contain all components required by the host site. The test plan must be approved prior to site mobilization for the full scale demonstration. The draft test plan shall be submitted to DOE and DOE-selected representatives at the demonstration site and DOE/NETL for review and approval. Any modifications must be made, and the test plan must be resubmitted and accepted for approval.

Task 9.0--Full-scale Demonstration

Contractor shall conduct a full scale demonstration at a site selected jointly by the contractor, the DOE demonstration site, and DOE/NETL, using the prototype system developed to access the difficult subsurface conditions and to determine contaminant spatial distribution and quantity in concentration levels. Task shall include activities necessary to complete verification of these field test results using independent field sampling, control tests, or other acceptable means. Task also includes support activities necessary to complete field testing that shall include, but are not limited to the following: site mobilization/demobilization; site preparation; facilities/utilities requirements; waste management and decontamination; and site restoration. The test plan must be approved by DOE and DOE selected representatives of the demonstration site prior to conducting these activities. The contractor shall coordinate fully with the demonstration site to perform these activities as planned in the approved test plan.

Mobilization and Demobilization
The contractor shall coordinate with the demonstration site to mobilize and bring the prototype technology system to the site along with all required personnel. At completion of field testing activities, the contractor shall demobilize equipment and personnel.

Site Preparation, Facilities/Utilities, and Waste Management Preparation and Management
The test plan must be approved prior to conducting these activities. Prior to any site work, all ES&H document control and reporting, regulatory document and control reporting requirements, and any other site-specific documentation must be submitted and approved by the DOE demonstration site.

This element includes the Contractor's responsibility to coordinate with the demonstration site DOE and contractor representatives for all required site preparation, utilities, waste management, and other specific resources required to support the demonstration project. These requirements are technology specific, and the contractor shall coordinate with the demonstration site to ensure that all required support is readied prior to commencing of field testing. For example, this may include preparing a staging area for equipment and other materials needed during the field demonstration. In addition, the contractor shall coordinate with the demonstration site to ensure all facilities/utilities requirements needed for the field demonstration are readied. The contractor shall provide sources for these requirements, as coordinated with and approved by the demonstration site. The contractor shall also coordinate with the demonstration site in determining waste management requirements and health and safety requirements for the field testing. The contractor shall coordinate with the demonstration site to ensure waste management requirements prior to, during, and after any field testing are met.

Full Scale Field Demonstration
The contractor shall complete the necessary activities to conduct full scale demonstration of the prototype technology system at the demonstration site according to the approved test plan. The contractor shall coordinate with the demonstration site representatives to ensure that all site requirements are met prior to, during, and after the field tests.

It is expected that the demonstration site selected will contain subsurface settings that are representative of difficult conditions to access and characterize contamination such as the 200-ZP-1 Operable Unit in the 200 West Area of Hanford. It is expected that DNAPL contamination, such as carbon tetrachloride in both the vadose zone and saturated zone, will be targeted for characterization. It expected that the full scale demonstration site selected shall include a minimal field area that is bound by surface dimensions of approximately 230 meters by 230 meters. The test area may contain existing wells varying in number from zero to twenty or more. Contamination concentration levels within the designated test area may vary for the targeted contaminant. Contamination may be found in the vadose zone, the saturated zone, or both.

The operational conditions are expected to fall within the following: required depth of operation ranges from surface to 110 meters; operation in both the vadose zone and saturated zone for both the access methodology and the methodology for determining contaminant spatial distribution and quantity in concentration levels; carbon tetrachloride contamination that may be present in the vadose zone (soil vapor, soil moisture, sorbed to solids, and residual) and the groundwater that is expected to range from minimum of 5 micrograms per liter to maximum of 10,000 micrograms per liter; carbon tetrachloride contamination may reside with other co-contaminants that may be radionuclides and other chemicals; subsurface settings that contain one or more conditions described as difficult-to-access such as beneath and around buildings and other man-made structures such as underground tanks and buried pipelines, layers of gravel, layers of caliche, and complex sediment facies such as interbeds of silt, sand, and gravel and/or beds containing structures such as fractures and clastic dikes.

The tests shall include operation of the prototype technology system for data collection, reduction, analyses, and interpretation. Field testing interval shall be the length of time specified in the approved Test plan. Not later than 48 hours from the start of the testing, initial test results from the data acquisition shall be provided in a “Quick Look” report that shall be in a format that is specified in the approved test plan. Initial test results shall be evaluated, as specified in the approved test plan, to determine if the prototype system is operating properly. All results from the testing, shall be provided at the time intervals and in a format that was specified in the approved test plan. Testing results shall also be provided in the Final Report submitted at the completion of Phase II.

The field test results shall be evaluated with respect to meeting the twofold objectives: 1) to access contamination located in both the vadose zone and saturated zone in difficult subsurface conditions and, 2) use in situ field measurement techniques to determine contaminant spatial distribution and quantity in concentration levels. The number of and degree to which the following performance criteria are met shall be evaluated:

- Ability to access and determine CCl_4 concentration levels in vadose zone (soil vapor, soil moisture, sorbed to solids, and residual) and groundwater in difficult subsurface conditions that include complex sediment facies, gravel, caliche, beneath man-made obstructions, and excessive depths (greater than 85 meters). Must be capable of measuring CCl_4 levels in groundwater ranging from maximum of 10,000 micrograms per liter CCl_4 to minimum of 5 micrograms per liter CCl_4. CCl_4 may occur in both aqueous phase and free phase (DNAPL).

• Capable of depth profile measurements ranging from the surface to depths of approximately 110 meters and capable of making measurements at multiple depths at discrete points on scale of several centimeters.

• Ability to provide real-time measurements and data results. A system with automatic measurements that is capable of remote downloading is preferred. Technologies that take advantage of existing extraction, injection, or monitoring wells, would be permitted.

• Ability to use measured concentration levels to produce spatial plots with the location and concentration of CCl_4 contamination both above and below the water table. Ability to report results in field coordinates and through use of visualization tools to plot isopleths of concentrations. Ability to map discrete lenses and pools of variable concentrations within the entirety of the plume. Methodology may involve integration of techniques, therefore integrated results are desired within 48 hours.

• Ability to measure time-variant changes of the combined plume configuration (spatial distribution) and the concentration levels, and provide results within 48 hours.

• Non-invasive or minimally invasive, eliminate or reduce Investigative Derived Waste (IDW), and prevent cross-contamination. For example, use of sensors in existing wells, use of geophysical or other remote sensing technologies, and methodologies involving cross-hole tests reduce or eliminate IDW.

• Robust in order to operate in remote, harsh field environment where access is limited and utilities are not readily available.

• Ability to provide technology performance and results which are verifiable with independent field data, controlled tests, or other acceptable means.

• Ability to minimize operational time including rapid site mobilization, completion of operations, and demobilization. The technology should operate reliably, with minimal scheduled or unscheduled outages for maintenance or repair.

• Demonstrated cost savings compared to baseline drilling and sampling methods, and able to operate within acceptable demonstration site Environmental, Safety, and Health requirements, and regulatory and stakeholders requirements.

<u>Independent Validation of Results</u>
The contractor shall complete an independent validation of test results that were obtained with the prototype technology system, using an acceptable plan that was provided in the approved test plan. This independent validation is intended to corroborate the operation of the prototype

technology system, and to be a measure of its accuracy and ability to meet the performance criteria. For example, baseline sampling methods, control testing, or other acceptable means approved by DOE and the demonstration site could be used to verify field results. Results of this validation testing shall be provided as outlined in the approved test plan.

Site Restoration

The Contractor shall coordinate with DOE and the demonstration site representatives with regards to demobilization and site restoration, to ensure acceptable conditions upon completion of the field testing. The site shall be reclaimed to a condition as coordinated with and acceptable to the DOE demonstration site.

Task 10-- Reporting

Draft Innovative Technology Summary Report (ITSR).

The Contractor shall prepare a draft ITSR documenting the performance of the technology during the full-scale demonstration. In this report, the Contractor shall provide, at a minimum, a summary, technology description, performance, technology applicability and alternative, cost, regulatory and policy issues, and lessons learned. This report is due sixty (60) days prior to the expected completion of the contract. The Contracting Officer's Representative shall provide to the contractor a sample ITSR and ITSR preparation guidance for the ITSR.

Final Report.

The contractor shall prepare and present a briefing of Phase II results at DOE/NETL or another site selected by DOE. This presentation shall take place not less than 45 days before the expiration of the Phase II contract. The contractor shall prepare for review and comments, a draft Final Report on the Phase II contract activities. This report shall follow the guidelines set forth in the contract and shall include, but not be limited to: prototype system design, constructing, and control testing; required project test plans and other documentation for the demonstration site; description of and results from Phase I and Phase II testing; results from independent validation; and cost estimates of technology and cost benefits of technology compared to baselines and alternative technologies. After review and comment by the DOE and DOE selected representatives, the contractor shall revise the report and submit to DOE.

Annual Industry Programs Conference Attendance

The Contractor shall attend and prepare project status for presentation at the Annual Industry Programs Contractor Review Meeting at DOE/NETL.

Subsurface Contaminant Focus Area Program Review Attendance

The Contractor shall attend and prepare project status for presentation at the annual Subsurface Contaminant Focus Area Program Review at a location to be designated.

C. DELIVERABLES

The Topical and Final reports shall be submitted in accordance with the attached "Reporting Requirements Checklist" and the instructions accompanying the checklist. In addition, the Contractor shall submit the following:

1. Documentation for coordinating and planning, as described in Task 1.
2. Base maps of test sites, as described in Task 2.
3. Prototype design, as described in Task 3.
4. Plan for and results of control testing, as described in Task 3.
5. Test plan for Phase I field tests, as described in Task 4.
6. Quick-Look Report and other data results including validation results, as described in Task 5.
7. Topical Report, as described in Task 6.
8. Documentation for coordinating and planning, as described Task 7.
9. Base maps of full scale demonstration sites, as described in Task 7.
10. Test plan for Phase II full scale demonstration site, as described in Task 8.
11. Quick-Look Report and other data results including validation results, as described in Task 9.
12. Draft Innovative Technology Summary Report, as described in Task 10.
13. Final Report, as described in Task 10.
14. Prototype technology system including all hardware, software, and support documentation.

D. BRIEFINGS/TECHNICAL PRESENTATIONS

1. Kickoff briefing with DOE/NETL, the selected demonstration site, and other DOE-selected representatives at site to be selected by DOE.
2. Briefings at DOE/NETL or other site selected by DOE upon completion of : (1)Phase I field tests; and (2) Phase II full-scale demonstration.
3. Annual presentations at NETL Annual Industry Programs Contractor Review Meeting.
4. Annual presentations at the Subsurface Contamination Focus Area Midyear Review Meeting.

ATTACHMENT 2

General Background and Demonstration Site Description and Requirements

General Background

After years of designing, manufacturing, and testing nuclear weapons, the DOE is faced with the challenge of cleaning up the hazardous waste left behind. More than 5,700 known DOE groundwater plumes have contaminated more than 475 billion gallons of water. DOE landfills contain more than 3 million cubic meters of buried waste contaminating the surrounding environment. At DOE sites throughout the country, soil, groundwater, and landfills containing or contaminated with hazardous and radioactive contaminants have special cleanup needs.

This technology demonstration is focused on Dense Nonaqueous Phase Liquid (DNAPL) contamination (carbon tetrachloride, trichloroethylene, tetrachloroethylene, and others) in difficult subsurface conditions, and improved, more cost-effective technologies that operate in these difficult conditions to assess contamination. DOE Nuclear Complex Sites such as Hanford, Paducah, Portsmouth, Pantex, Savannah River, Oak Ridge, and others, all have DNAPL plumes that contaminate soil and groundwater in subsurface conditions that are difficult to access and/or hamper assessment of contamination. These conditions include: soils that are difficult to penetrate; complex sediment facies that is highly heterogeneous and/or contains complex structures; contamination that underlies man-made structures such as buildings, pipes, and tanks; excessively deep contamination (greater than 45 meters); and others. In these difficult conditions, the need is to improve detection of contamination, to improve measuring concentration levels in the field, and to improve mapping plumes (spatial distribution of contaminants) and time-variant changes. The goal of this project is to design, develop, and demonstrate a novel and innovative technology system to: (1) access the contamination in difficult subsurface conditions, and (2) perform in situ characterization of contamination to determine spatial distribution and quantity in concentration levels. Novel and breakthrough field technologies that do not duplicate existing methods are desired.

The technology will be selected on the basis of a matrix of integrated functions, issues, and performance requirements. They include: (1) focus of DOE Complex enduser needs (DOE site enduser's likely commitment to technology based on performance, fulfilling site needs, and others; novel and innovative nature of technology (not redundant of existing technologies)); and prevalence of the need for the technology within the DOE Complex; (2) technical and engineering issues (technical viability; engineering feasibility; advanced level of technology maturity; technical performance over baseline; effect of use of technology, e.g. secondary waste reduction); (3) benefits of the technology (risk reduction compared to baseline; cost reduction compared to baseline; return of investment; and leveraging of funds and resources); and (4) acceptance and compliance issues (stakeholder acceptance, and regulator acceptance and ability for technology to meet regulatory compliance).

As stated above, a matrix of functions, issues, and performance requirements will be used to select the technologies for this demonstration. A key requirement of the selected technology will be that it has attained the Engineering Development Stage. This requirement is necessary to expeditiously complete final design and fabrication of the technology system, then conduct pilot scale testing and full scale demonstration of the system. The DOE Environmental Management Technology Decision Process defines numerous technology maturation levels or stages, of which the Engineering Development Stage is one. Requirements for reaching the Engineering Development Stage have been defined by numerous criteria that address the following: technology enduser need; technical merit; cost; safety, health, and environmental protection, and risk; stakeholder, regulator, and tribal issues; and commercial viability. Several technical merit or cost criteria are considered crucial for this project attaining status of Engineering Development Stage. These are listed below:

1. Evidence that technical feasibility has been demonstrated and that the technology met performance requirements. This evidence included summaries of proof-of-principal and/or laboratory-scale experimentation. Clear and direct scale-up capability for future prototype and full-scale demonstrations and implementations were provided.

2. Proposed methods or approach for technology demonstration and implementation are scientifically based. The scientific basis for moving the technology from proof-of-principal and laboratory-scale experimentation to prototyping was provided.

3. Proof of the design of the technology application was provided. Evidence was provided that the design of the technology for application was completed. Evidence may have included full-scale laboratory testing results, preliminary field testing results, technical specification, and infrastructure development plans.

4. A clear cost benefit associated with continued investment in the research and development of the technology was clearly demonstrated. Evidence was provided of cost savings/cost avoidance and return on investment through use of the technology.

Although the technology will be required to operate under broad subsurface conditions encountered at DOE sites in both the vadose zone and saturated zone, it is imperative that the selected technologies be developed and show successful demonstration at the selected test areas at the Hanford Site.

<u>Hanford Demonstration Site</u>

At the Hanford 200 West Area, carbon tetrachloride (CCl_4) is present in the vadose zone and groundwater (see Figure 1) (see References). The vadose zone and unconfined aquifer consist of a thick accumulation of unconsolidated to semi-indurated sediments composed of silts, sands, and gravels. The water table is located at about 65 meters, and groundwater flows within a multi-aquifer system. Between 1955-1973, CCl_4 was discharged to the soil column in this area in aqueous mixtures and in nonaqueous phase (DNAPL). The plume of dissolved CCl_4 that resulted from these discharges, extends over 11 square kilometers in the unconfined aquifer under 200 West Area. The highest concentrations of CCl_4 in the 200 West Area groundwater are approximately 8,000 micrograms per liter. Dissolved CCl_4 has been observed deep within the unconfined aquifer (greater than 10 meters below water table) and within the uppermost confined aquifer. Difficult conditions that hamper assessment of the plume in the 200 West Area include the complex sediment facies that control fluid transport, gravel lenses, well-cemented caliche layers, man-made obstructions (buildings, tanks, others), and extensive and deep contamination. Technologies that allow access to this wide variety of sediments for both characterization and remediation are required. In addition, costs to characterize and monitor this deep and large plume with conventional technologies such as drilling and sampling are excessive, and significant cost-savings could be realized with improved methods. In situ monitoring would reduce the labor-intensive process of sampling, handling, and shipping samples for analyses. These data could also provide highly accurate isopleths of contaminant concentrations to aid fate and transport modeling and construction of remediation systems.

The goal of this project is to design, develop, and demonstrate a novel and innovative technology system to: (1) access the contamination in difficult subsurface conditions, and (2) perform in situ characterization of contamination to determine spatial distribution and quantity in concentration levels. Qualifying technologies can be a combination of technologies integrated together, and should be capable of meeting the identified field performance requirements. Expeditious field demonstrations at DOE sites that include Hanford are desired for qualifying technologies, and a full scale demonstration at DOE Hanford is anticipated. To that end, the following are anticipated performance requirements that would be required for a full-scale demonstration at a Hanford 200 West demonstration site to assess CCl_4 contamination in difficult subsurface conditions:

- Ability to access and determine carbon tetrachloride (CCl_4) concentration levels in vadose zone (soil vapor, soil moisture, sorbed to solids, and residual) and groundwater in difficult subsurface conditions that include complex sediment facies, gravel, caliche, beneath man-made obstructions, and excessive depths (greater than 85 meters). Must be capable of measuring CCl_4 levels in groundwater ranging from maximum of 10,000 micrograms per liter CCl_4 to minimum of 5 micrograms per liter CCl_4. CCl_4 may occur in both aqueous phase and free phase (DNAPL).

- Capable of depth profile measurements ranging from the surface to depths of approximately 110 meters and capable of making measurements at multiple depths at discrete points on scale of several centimeters.

- Ability to provide real-time measurements and data results. A system with automatic measurements that is capable of remote downloading is preferred. Technologies that take advantage of existing extraction, injection, or monitoring wells, would be permitted.

- Ability to use measured concentration levels to produce spatial plots with the location and concentration of CCl_4 contamination both above and below the water table. Ability to report results in field coordinates and through use of visualization tools to plot isopleths of concentrations. Ability to map discrete lenses and pools of variable concentrations within the entirety of the plume. Methodology may involve integration of techniques, therefore integrated results are desired within 48 hours.

- Ability to measure time-variant changes of the combined plume configuration (spatial distribution) and the concentration levels, and provide results within 48 hours.

- Non-invasive or minimally invasive, eliminate or reduce Investigative Derived Waste (IDW), and prevent cross-contamination. For example, use of sensors in existing wells, use of geophysical or other remote sensing technologies, and methodologies involving cross-hole tests reduce or eliminate IDW.

- Robust in order to operate in remote, harsh field environment where access is limited and utilities are not readily available.

- Ability to provide technology performance and results which are verifiable with independent field data, controlled tests, or other acceptable means.

- Ability to minimize operational time including rapid site mobilization, completion of operations, and demobilization. The technology should operate reliably, with minimal scheduled or unscheduled outages for maintenance or repair.

- Demonstrated cost savings compared to baseline drilling and sampling methods, and able to operate within acceptable demonstration site Environmental, Safety, and Health requirements, and regulatory and stakeholders requirements.

REFERENCES[1]

1. DOE, 1997. Linking Legacies. DOE/EM-0319. Washington, D.C. 230 pp.

Available from:
The Environmental Management Information Center
Office of Strategic Planning and Analysis
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585
(202) 586-9280 and (800) 736-3282

2. Swanson, L.C., Rohay, V.J., and Faurote, J.M. (CH2M Hill Hanford, Inc.), 1999, Hydrogeologic Conceptual Model for the Carbon Tetrachloride and Uranium/Technetium Plumes in the 200 West Area: 1994 through 1999 Update, Prepared for the U.S. Dept. Of Energy, Richland Operations Office, Submitted by Bechtel Hanford, Inc., BHI-01311, Rev. 0, 133 pp. Go to the Richland Environmental Restoration Project Internet Library and then select the document BHI01311. (LINK=http://www.bhi-erc.com/library/bhi.htm)

Also available from:
U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

3. DOE-Hanford homepage (LINK=http://www.hanford.gov) and Hanford Site Technology Coordination (STCG) Website for technology need statements (LINK=http://www.pnl.gov/stcg). See Hanford STCG Need Numbers: RL-SS03 and RL-SS25. (LINK=http://www.pnl.gov/stcg/fy00needs/technology/ss/rl_ss03.stm and LINK=http://www.pnl.gov/stcg/fy00needs/technology/ss/rl_ss25.stm)

4. DOE-Environmental Management homepage link to all DOE sites and their technology need statements. (LINK=http://www.em.doe.gov/info/scitech.html)

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[1] Publication charges may apply and are the responsibility of the requestor.

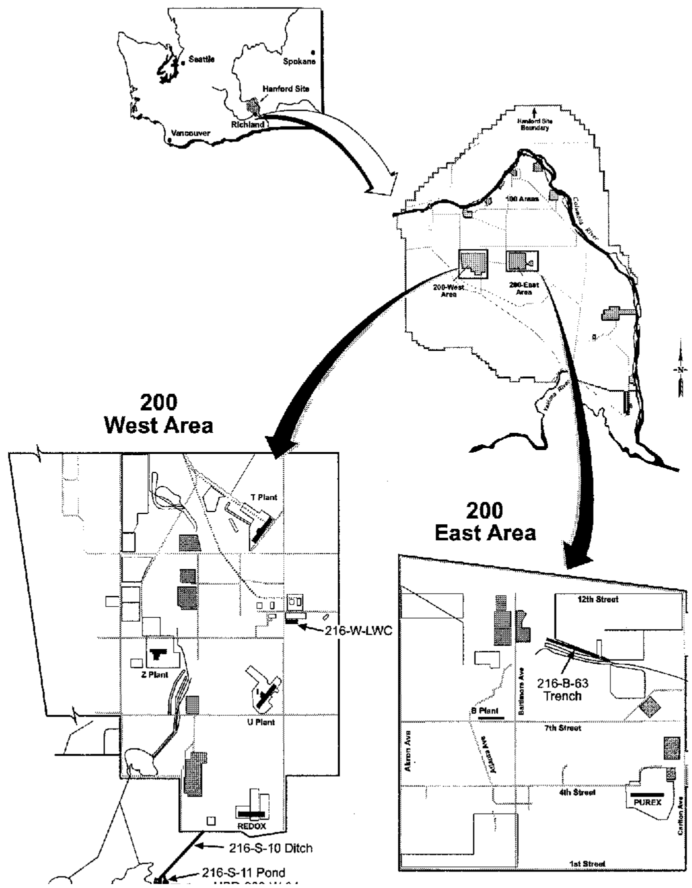

Figure 1. Map that shows Hanford Site in Washington State and the location of the 200 West Area.